



# Magic, science and masculinity: marketing toy chemistry sets

Salim Al-Gailani

Department of History and Philosophy of Science, University of Cambridge, Free School Lane, Cambridge CB2 3RH, UK

## ARTICLE INFO

### Keywords:

Chemistry sets  
Advertising  
Gender  
Magic  
Toys

## ABSTRACT

At least since the late nineteenth century, toy chemistry sets have featured in standard scripts of the achievement of eminence in science, and they remain important in constructions of scientific identity. Using a selection of these toys manufactured in Britain and the United States, and with particular reference to the two dominant American brands, Gilbert and Chemcraft, this paper suggests that early twentieth-century chemistry sets were rooted in overlapping Victorian traditions of entertainment magic and scientific recreations. As chemistry set marketing copy gradually reoriented towards emphasising scientific modernity, citizenship, discipline and educational value, pre-twentieth-century traditions were subsumed within domestic—and specifically masculine—tropes. These developments in branding strategies point to transformations in both users' engagement with their chemistry sets and the role of scientific toys in domestic play. The chemistry set serves here as a useful tool for measuring cultural change and lay engagement with chemistry.

© 2009 Elsevier Ltd. All rights reserved.

When citing this paper, please use the full journal title *Studies in History and Philosophy of Science*

## 1. Introduction

Toy chemistry sets, simultaneously incorporated into projections of elite scientific identity and deliberations on childhood leisure, are imbued with considerable cultural resonance. In *English men of science: Their nature and nurture* (1874), Francis Galton identified the chemistry set as providing an initiating function or starting point to a scientific career, a conviction that has become engrained within standard scripts of the achievement of eminence in science.<sup>1</sup> Stephen Jay Gould once declared that scientists are 'generally poor communicators', and as children were probably most content 'sitting in their basements with chemistry sets'.<sup>2</sup> But chemistry sets have also provoked parental anxiety: surely, complained one concerned parent in a letter to *The Times* in 1903, 'the placing in the hands of young boys of such ingredients as chlorate of potash, sulphur, &c., must always be deprecated as a temptingly dangerous

proceeding' (Leigh, 1903, p. 8). Conversely, the transformation and perceived decline of the chemistry set has also served as a measure of an increasingly litigious society (Sacks, 1999; Von Korff, 2006). These clichés remind us that chemistry sets, like all toys, are not just about play.<sup>3</sup> For Roland Barthes, 'toys always mean something, and this something is entirely socialized, constituted by the myths or the techniques of modern adult life' (Barthes, 2000, p. 53). The iconic—or, in Barthes's phraseology, 'mythological'—centrality of toy chemistry sets to modern scientific self-representation makes the limited attention they have received from historians of science surprising.<sup>4</sup> This oversight is all the more striking given the obvious value of chemistry sets as artefacts; their longevity as popular toys means that they are a potentially rich resource for studies seeking to explore lay engagement with science over time.

Chemistry sets have figured, however, in scholarship on the history and sociology of toys; museum exhibitions exploring popular

E-mail address: [ssa32@cam.ac.uk](mailto:ssa32@cam.ac.uk)

<sup>1</sup> On Galton, see Gee (1989), p. 37. For chemistry sets in more recent scientific reminiscences, see Brockman (2005), Hargittai, (2002), pp. 117–128; Schmidt (2000), Von Korff (2006).

<sup>2</sup> Quoted in Brehm (1999).

<sup>3</sup> For a classic study of the sociology of play, see Huizinga (1970); on the sociology of toys, see Ball (1967), p. 447.

<sup>4</sup> Cooter and Pumfrey's observation that 'our ignorance of both the low drama and the high art of science's diffusion and modes of popular production and reproduction', including chemistry sets, is 'staggering', remains true (Cooter & Pumfrey, 1994, p. 237). Brian Gee has examined the proliferation of chemical amusement chests in Victorian Britain in the context of the rise of the institutionalised research laboratory (see Gee, 1989, pp. 37–59).

culture; and in corporate histories and biographies of individual toy manufacturers.<sup>5</sup> Like the nostalgic recollections of scientists, however, many of these accounts assume the existence of an immutable ‘chemistry set’ (in particular, see Cross, 1997, pp. 53, 64, 72). On the contrary, a relatively small sample of these toys manufactured in the United States and Britain from the early twentieth century to the late 1960s, in the collection of the Whipple Museum for the History of Science in Cambridge, suggests that such a generalisation is problematic. Manufacturers sold extensive ranges of these toys varying in design, content, size and price marketed for different consumers. This was equally characteristic of commercial chemistry set production in both Victorian Britain and twentieth-century America (Gee, 1989; see also Griffin, 1879, p. 565; Chemcraft, 1929).<sup>6</sup> Though portable laboratories and educational scientific apparatus were available in Britain and the United States since the mid-eighteenth century, chemical cabinets sold as commodities for children only took off from the 1830s (Gee, 1989; Turner, 1987, pp. 377–398; Warner, 1988, pp. 387–397). Justifying often expensive scientific apparatus as a juvenile recreation required manufacturers to market both chemistry and the objects themselves as suited to the burgeoning market for middle-class leisure in the second half of the nineteenth century.

This was equally true of chemistry sets sold by two large American toy companies, Gilbert and Porter Chemcraft, who dominated the scientific and educational toy industry in the United States from roughly 1915 until the late 1960s (Pursell, 1979, p. 253).<sup>7</sup> Chemcraft claimed in one post-war advertisement to have sold over five million chemistry sets since 1916 (Chemcraft, n.d., p. 3).<sup>8</sup> Gilbert and Chemcraft chemistry sets were among several American manufacturers to take advantage of a stagnating European toy industry from the onset of the First World War. The expansion of chemistry set production also coincided with the emergence of a burgeoning advertising industry ever more alert to design and visual effect, and exemplifies the formation of a consumer society—the creation of mass-markets for mass-produced products—in the United States in the decades around 1900.<sup>9</sup> The Gilbert Company increased spending on advertising from \$14,000 in 1914 to almost \$145,000 in 1916 (Gilbert & McClintock, 1954, pp. 132, 143). Gilbert and Chemcraft toys, available in abundance on internet auction websites, continue to attract interest from collectors and enthusiasts.<sup>10</sup> These brands’ ubiquity has had an unparalleled influence on the shaping of the chemistry set icon.<sup>11</sup> This article situates Gilbert and Chemcraft marketing copy within broader advertising motifs of the most formative decades of American advertising, ca. 1920–ca. 1950, and explores the techniques manufacturers used to create thematized, meaningful commodities. Though Gilbert and Chemcraft were highly innovative in developing new and distinct marketing techniques for the American market, this article stresses that profound continuities nonetheless remained between chemistry sets advertised by these brands in twentieth-century America, and chemical recreations sold in Victorian Britain. In both contexts, it examines iconography-laden chemistry set ephemera: advertising, packaging (as point of sale advertising), themed experiment books and instruction manuals.

The historian of advertising Roland Marchand influentially posited that advertising does not act as a mirror of social realities, but as a ‘Zerrspiegel’, a distorting mirror that enhances some images at

the expense of others’ (Marchand, 1985, p. xvii). Twentieth-century toy chemistry sets, by virtue of their marketing copy, are indeed objects laden with visual and literary imagery that tell us much about how manufacturers have both responded to and manipulated historically contingent cultural values and popular interests: gender, magic and enthusiasm for science and technology. Studies of material culture have drawn attention to the appearance of new commodities from the late nineteenth century suited to a consumer regime structured around notions of the ‘male breadwinner’ and ‘female domesticity’ (for instance, de Grazia & Furlough, 1996, esp. pp. 251–274). Historians of technology have also shown how technological artefacts have become closely associated with gender and highlighted how retailers have historically exploited and reinforced gendered identities for their products and target consumers (see Lerman et al., 2003, pp. 1–12). Manufacturers’ expectations and assumptions about masculinity are particularly apparent in chemistry set marketing copy in the United States in the twentieth century. In attempting to unravel these overlapping cultural threads, the discussion necessarily extends beyond the toys themselves. In particular, I assess the diverse range of handbooks devoted to scientific recreations, including chemistry, which also proliferated in the nineteenth and twentieth centuries.

This article stresses that the meaning of ‘the chemistry set’ has always been sensitive not only to the literary and visual cues with which they were marketed, but also to the contexts and spaces in which they (have) appear(ed). The mutability of these ‘objects’ is particularly apparent in the Harry Price Library of Magical Literature at the Senate House Library, University of London, ostensibly a collection of magical literature; in the context of this collection, their status as toys is problematised. In the first section, I use Price’s library to assess the place of the ‘toy chemistry set’ within the wider culture of chemical amusements in the late nineteenth and twentieth centuries. The second section emphasises the rootedness of these toys in an enlightenment tradition of rational amusements, suggesting that the influence of ‘natural magic’ continued to shape the iconography and pedagogical function of chemistry sets well into the twentieth century (Stafford, 1994, esp. pp. 1–71). I explore the ways in which chemistry set manufacturers negotiated between science and magic in marketing copy. I suggest that manufacturers increasingly stressed the role of the chemistry set in creating a new generation of scientists at the expense of ‘chemical magic’ and the pedagogy of demystification by performance. The final section assesses chemistry set marketing in the context of wider trends in contemporary advertising. I link the view advanced by manufacturers that the chemistry set played an integral part in shaping a hi-tech, industrial future for the United States, with the promulgation of domestic and specifically masculine values through these toys.

## 2. Anglo-American chemical recreations in the Harry Price Library

In the vast collection of magical literature and apparatus deposited in the University of London Library by the controversial

<sup>5</sup> For more general considerations of Anglo-American toy industries, see Cross (1997), Pursell (1979). For museum exhibitions, see *History in your home* (n.d.). For biographies and corporate histories, see Gilbert & McClintock (1954), Watson (2002), Tyler (2003).

<sup>6</sup> This was generally true of educational toys available in Britain and the United States in the period 1920–1960. The Gilbert Company sold wireless telegraphy kits in the 1920s, atomic energy kits in the 1950s, and ecology kits in the 1970s (see Pursell, 1979, p. 253).

<sup>7</sup> Gilbert was the manufacturer, from 1913, of the successful ‘Erector Set’. In 1961, Porter Chemcraft merged with another leading toy manufacturer, the Lionel Corporation, while the Gilbert Company folded in 1967 (Tyler, 2003, pp. 49–58; Watson, 2002, pp. 184–192).

<sup>8</sup> This is at odds, however, with John Tyler’s estimate of one million Chemcraft sets sold in the near seventy year history of the company (Tyler, 2003, p. 59).

<sup>9</sup> See Cross (1997, 2000); on the rise of the advertising industry in this period, see Fox (1997), Laird (1998).

<sup>10</sup> Chemistry sets made by the Gilbert and Porter Chemcraft brands were routinely referred to as ‘chemistry outfits’.

<sup>11</sup> In his recent study of contemporary advertising, Ernest Sternberg describes the icon as a ‘commodity that has acquired added value through the commercial heightening of meaning’ (Sternberg, 1999, p. 4).

researcher into psychic and occult phenomena, Harry Price, handbooks and pamphlets dedicated to scientific recreations, including amusements and experiments in chemistry, occupy a prominent place. The collection includes instruction manuals sold with youth laboratories and chemistry sets produced by prominent British and American makers of both scientific apparatus and toys, including Griffin (1860, 1879), W. E. Statham & Sons (n.d., 1903), Gilbert (1920) and Chemcraft (1922). The Harry Price Library reminds us that we must pay close attention to the changing relationship of experiment manuals to the chemistry sets they were usually attached to. Though the Library contains much apparatus for the performance of conjuring, and equipment from his Laboratory for Psychic Research, it appears Price preserved nothing of the sets themselves.<sup>12</sup> Price's elaborate portable 'ghost-hunting kit' does, however, contain chemicals and apparatus for performing experiments commonly featured in chemistry sets and manuals of chemical amusements; laboratory equipment became an important component of his carefully managed public persona (Price, 1936, p. 32).<sup>13</sup> Price's library of '17,000 volumes on magic of all kinds', moreover, shows that for an early twentieth-century collector of magical ephemera, chemical amusements, and scientific recreations more generally, were an integral part of the material and literary culture of conjuring (Price, 1942, p. 12). Detached from the advertising copy of later years, this collection helps us better place 'the chemistry set' in the context of wider cultures of lay chemistry in the late nineteenth and twentieth centuries.

As Brian Gee has convincingly argued, the emergence of cabinets of chemical amusements and youth laboratories in early Victorian Britain was closely tied to the more long-standing production of portable laboratories for natural philosophers (Gee, 1989). But the heritage of these objects and the texts which guided their use is equally apparent in the literary tradition of rational recreations (see Stafford, 1994). This includes Jane Marcet's best-selling *Conversations on chemistry* (1806), which presented the science as appropriate for children of both sexes (Knight, 2006). Though perhaps recognisable to us as chemistry sets, the cost and content of the expensive mahogany chemical cabinets advertised in the 1879 catalogue of the Holborn instrument-maker, J. J. Griffin, part of Price's collection, problematises their status as 'toys'.<sup>14</sup> However, with Griffin, chemical cabinets and experiment manuals began to be advertised as pedagogically complementary, and thus crystallised as a related commercial concern (see Gee, 1989). This became a key characteristic of pre-packaged chemical recreations marketed for children in the following century; toy chemistry sets were now rendered educationally valueless and even hazardous without the guiding, even disciplining presence of an enclosed instruction manual.

Chemistry cabinets, gradually recast as toys in the decades around 1900, presented the instruction manual as indispensable to proper experimentation. Yet, pre-packaged apparatus cannot be said to have ever entirely monopolised the market for lay chemistry. Along with manuals attached commercially to chemistry sets, Harry Price acquired a significant number of handbooks and penny pamphlets written by science popularisers that instructed children how to perform chemistry experiments without the aid of pre-packaged material. Rational recreations as a genre

had traditionally presented science as an inexpensive activity using easily obtainable materials and household apparatus: 'such things as every house, the humblest in the land, possesses' (Good, 1894, p. i; see also Brunel, 1901, p. i). Around the turn of the twentieth century, popular manuals of chemistry published in both Britain and the United States argued for independent acquisition of material for the demonstration of chemical processes and experimentation; chemicals, oils, metal filings, apparatus and glassware. This literature would typically provide a list of retailers from where such items may be obtained cheaply (for instance, *British standard handbook of chemical wonders for home exhibition*, n.d.).<sup>15</sup>

Victorian manuals of chemical recreations, whether associated with manufacturers of pre-packaged apparatus or not, were swathed in the moralising ideology of bourgeois culture. Instrument-makers and chemists such as Griffin and C. R. Alder Wright shared the aim of presenting chemistry as a suitable recreation for the middle classes. Chemistry was marketed as a science which 'appealed to mind, body and spirit', and cemented the social status of its aspiring practitioners by instilling physical and moral discipline (see Knight, 2004, pp. 131–140). In the 1860 edition of his *Popular manual of chemical recreations*, Griffin conceived of chemistry as a didactic tool, claiming that 'no subject [is] better calculated to encourage that generous love of truth which confers dignity and superiority on those who successfully pursue it ... [and] none which affords more striking proofs of the wisdom and beneficence of the Creator of the Universe' (Griffin, 1860, p. 2). Moreover, 'Chemistry is a subject qualified to train both the *mind* and the *hands* of young people to habits of industry, regularity, and order' (ibid., pp. 2–3). Three decades later Alder Wright promised that users of his playbook of science would acquire not only 'the faculty of observation ... the power of reasoning ... [and] the cultivation of mental powers' but also 'the habit of manual dexterity' and 'neatness', losing their 'awkwardness' (Wright, 1890, pp. i, xxv). The authors of the two-penny *British standard handbook of chemical wonders for home exhibition* agreed that the practice of chemistry inculcated 'common sense, attention, neatness, and above all, cleanliness and dexterity' (*British standard handbook of chemical wonders for home exhibition*, n.d., p. 4).

The publication of these texts and the production of early chemistry sets for children coincided with the final years of a so-called 'Golden Age of stage magic' (During, 2002). Propelled largely by its enormous popular appeal as a domestic hobby and the international fame of stage performers, magic occupied a crucial place in the emerging market for both working and middle class leisure.<sup>16</sup> Between the mid-nineteenth century and the early decades of the twentieth century, magic proliferated in practical how-to guides, popular science periodicals and children's magazines (see ibid., pp. 107–177). In these handbooks, the relationship of chemistry and what Simon During has helpfully termed 'secular magic'—the technically produced magic of conjuring, illusions or special effects as distinguished from a 'magic of rituals, myths and fetishes ... superstition or credulity'—is perhaps most apparent (ibid., pp. 1–42). In late Victorian juvenile literature, chemistry and conjuring were so closely bound up that one journal, published in 1881, went as far to say that 'most so-called magical illusions are

<sup>12</sup> Price is unlikely to have owned a Chemcraft or Gilbert set at all, as instruction manuals could be ordered separately; this continued to be the case in subsequent decades. I am grateful to Rosie DiVernieri for this suggestion.

<sup>13</sup> The kit contained equipment Price used to investigate reports of paranormal phenomena, most famously at Borley Rectory in 1929. On Price's life see Tabori (1950), Hall (1978). On the Harry Price Library as a working collection, see Connor (2002).

<sup>14</sup> 16 shillings for the cheapest, rising to 52 shillings and sixpence for the most expensive. The cabinets were 'prepared to suit the wants of the student of Chemistry who wishes to possess means of performing the experiments he witnesses at lectures or finds described in books' (Griffin, 1879, p. 565).

<sup>15</sup> For a later example of this, see Taylor (1934). Frank Sherwood Taylor, later Director of the Science Museum in London insisted in the first edition of his popular book, *The young chemist*, that 'with very little to spend, you can do some real chemistry' (Taylor, 1934, p. v).

<sup>16</sup> On the expanding market for middle class leisure circa 1850, see Bailey (1978), esp. pp. 68–90; on magic as a middle-class leisure activity, see During (2002), esp. pp. 107–177.





**Fig. 1.** Front cover of *Chemical tricks, for home amusement and instruction* (Aldine Publishing Company, [1894?]; used with the permission of the The Harry Price Library of Magical Literature, Senate House Library, University of London). This pamphlet is undated but the same text was published in New York as a '10 cent advice book' by F. Tousey in 1894 (Anderson, 1894).

chemistry experiments'.<sup>17</sup> The authors of cheap 'penny-pamphlets' and 'ten-cent advice books' such as *Chemical tricks, for home amusement and instruction* (Fig. 1) and *How to do chemical tricks*, published in Britain and the United States respectively, made the claim that chemistry could be both instructive and entertaining (Aldine Publishing Company, [1894?], pp. 1–2; Anderson, 1894, pp. 1–3). Exploiting new techniques for cheaply printing brightly coloured plates and wrappers to increase the appeal of their pamphlets, these specialist publishers ambitiously claimed they 'put in everyone the power to know something' (*British standard handbook of chemical wonders for home exhibition*, n.d., p. i). Moreover, 'scientific truths will appear in every experiment that can be performed, whether those given in this little book or in the most learned treatise on chemistry' (Aldine Publishing Company, [1894?], pp. 1–2).<sup>18</sup>

The conceptual overlap between performance magic and chemistry also applied to commercially available pre-packaged apparatus sold in this period, advertised in handbooks in Price's collection. In the nineteenth and early twentieth centuries, the distinction between 'chemical magic' sets and more self-consciously scientific 'portable youth laboratories' was, at the very least, blurred. Davenport, a British manufacturer of 'magical novelties', sold chemistry sets under the title 'Chemical Magic Cabinets', which were endorsed by the renowned Maskelyne family, who dominated the entertainment magic industry in late Victorian and Edwardian London (Johnson, 1920, back cover). Around 1900, Hamley's Grand Magical Saloons of Holborn advertised their own-brand 'cabinets of chemical experiments' alongside joke sets and apparatus for the performance of conjuring, ventriloquism, 'shadowgraphy' and 'chapeaugraphy' (Hopkins, 1904, pp. i–ii). In the United States, Frederick Lowey & Co. of New York sold a 'Boy's Own Laboratory' for 'performing endless experiments in Chemical Magic' for the first time in 1882 (quoted in Pursell, 1979, p. 259).

Though drawing from the enlightenment tradition of natural magic, 'chemical magic' as a specific genre dates at least to the 1850s, when manuals of the type *The magician's own book*, introduced it alongside other categories of illusion: optical, mechanical and 'magnetical'.<sup>19</sup> Such handbooks instructed amateur conjurers how to incorporate chemistry 'experiments' into their parlour performances and by the time Price began his collection in the late 1890s, 'chemical magic' had developed into an independent area of 'magical' expertise in both Britain and America. 'Chemical magic' was framed by early twentieth-century professional magicians as a new and exciting magical specialism, necessary for 'the scientific conjuror who wishes to advance his art' (Hopkins, 1904, p. 101). In 1909, 'Professor' Ellis Stanyon offered courses in 'Fire and Chemical Magic' at his 'School of Magic' in West Hampstead. A simple experiment involving colour changing ink was lauded as 'real magic at last' (Stanyon, 1909, p. 2). In the same year, the conjuror William Linnett read a paper before the Society of American Magicians, in which he declared 'no science more adaptable' to magic than chemistry, and advised all magicians to familiarise themselves with chemical terms (Linnett, 1909, pp. 1–2). Linnett was one of a number of British and American magicians to write popular treatises on chemistry around 1900 (see also, Brunel, 1901; Hopkins, 1904; Johnson, 1912, 1920).

In 1930, Howard Thurston, one of America's leading entertainers in the 1920s, and fierce rival of Harry Houdini, was commissioned to write an introduction to a new manual of *Chemical magic* by John D. Lippy, a chemist and amateur conjuror. The 'miraculous' production of artificial silk, rubber and dyes by chemical scientists led Thurston to conclude that the '[c]hemistry of today might well be called modern magic' (Lippy & Thurston, 1930, p. xii). Secular magicians had since the mid-nineteenth century legitimated their trade by crusading against the dominant form of real magic at the time in spiritualism (During, 2002, pp. 149–177). Like another text in Price's collection, Houdini's *A magician among the spirits* (1924), Thurston's introduction was fiercely critical of spiritualism. Both polemics exemplified the rich sceptical tradition of American stage magic around 1900 (Houdini, 1924; Butler, 1990, pp. 67–97). In Thurston's ideal modernity, scientists would continue to succeed 'in duplicating the products of nature's laboratory—[and make] stronger, purer, and more interesting things of nature' (Lippy & Thurston, 1930, p. xii). Thurston's comments were characteristic of a broader trend of enthusiasm for science, technology and invention in American culture and society in this period.<sup>20</sup>

<sup>17</sup> See, for instance, *Seasonable indoor amusements: Chemistry and conjuring (1880–1881)*, *Straightforward conjuring tricks*, Pt. IV: Some curious cases of crystallisation (1880–1881).

<sup>18</sup> On new printing technologies and penny-publications in popular culture, see Anderson (1994).

<sup>19</sup> Williams (1857). On enlightenment natural magic, see Stafford (1994).

<sup>20</sup> On the 'age of technological enthusiasm', see Hughes (1990), Lienhard (2003).

Materials in the Harry Price Library underscore the complexity of the market for domestic chemical recreations in the decades around 1900. A range of producers: instrument-makers, scientific chemists, toy-makers, penny-publishers and magicians offered their wares to a socially diverse set of consumers. In these texts and objects, we can read competing claims about how chemical knowledge was best disseminated, and to which social groups; this rhetoric reciprocally reveals much, of course, about the social aspirations of the authors themselves. In targeting his didactic manual and cabinets at middle-class schoolmasters and 'students of chemistry' preparing for a career in industry, Griffin thinly veiled his efforts to portray chemists as representatives of bourgeois culture (see Knight, 2006). For magicians such as Linnett and Thurston, publishing treatises on chemistry for children in a climate of public enthusiasm for science consolidated their positions as allies of reason and scientific progress against spiritualism. Scientists and magicians, they argued, were drawn from the same stock: 'the boy of a scientific turn of mind may become a successful inventor or a skilled entertainer in magic through the application of an acquired understanding of the science of chemistry' (Lippy & Thurston, 1930, p. xii). The increasing movement of toy-makers, magicians, juvenile periodicals and penny-publishers into the business of science popularisation in the second half of the nineteenth century aimed to introduce chemical recreations to new audiences, yet readership is likely to have been chiefly limited to middle-class teenage boys (see Noakes, 2004, pp. 91–122). Through this period the literature increasingly differentiated their young audiences in terms of gender.<sup>21</sup> By 1900, the intertwined genres of 'scientific recreations' and 'natural magic', including the chemical tricks that fascinated Harry Price, were defined as masculine pursuits.

### 3. The 'young alchemist' and the 'boy chemist'

It is against this backdrop that two American companies, Porter Chemcraft and Gilbert, began producing chemistry sets, initially marketed as 'chemical magic kits'; Chemcraft in 1914 and Gilbert in 1917 (Schmidt, 2000, p. 42; Tyler, 2003, p. 2). The latter company's founder, A. C. Gilbert, was himself an amateur magician who sold conventional magic kits and professional conjuring apparatus under the brand 'Mysto Magic' (Watson, 2002, pp. 17–18). Both Chemcraft and Gilbert quickly expanded their product lines, and by the early 1920s sold sets ranging in cost from seventy-five cents in paperboard packaging printed with brightly coloured images, to ten dollars for a large wooden cabinet with over sixty different chemicals similar to those sold by Griffin in Britain in the previous century (Tyler, 2003, p. 6). These manufacturers thus consolidated the various material and textual elements of the 'chemical recreations' genre into a single range of products. Harry Price deposited early 'chemical magic' manuals published by both toy-makers in his collection, and chemistry sets branded in this way appear to have predominated Chemcraft's and Gilbert's early output of these toys.<sup>22</sup> Over the course of the next four decades, the range of chemistry sets available to consumers broadened and marketing copy increasingly emphasised their scientific authenticity. This section explores the how the divergent marketing strategies of 'chemical magic' and 'boy chemistry' were negotiated, suggesting that this thematic shift had implications for the pedagogical philosophies, design and content of twentieth-century American chemistry sets.

In 'chemical magic' manuals, experiments were labelled chemical 'wizardry', 'witchcraft' and 'sorcery', both 'diabolical' and 'mys-

terious', while materials provided with the toys, chemical transformations and their products, were described figuratively as well as literally. A solution of sodium bisulphate and azurite, for instance, was cast as a 'magic blue liquid' for the alchemical 'transmutation' of steel into copper (Chemcraft, 1922, p. 11). 'Chemical magic' sets, as well as independent handbooks in fact actively cultivated the notion that entertainment magic shared the alchemical heritage of chemistry. *The Chemcraft magic book* thus instructed children to play the part, not of the scientific researcher, but of the 'young alchemist who would display his supernatural gifts to his friends' (ibid., p. 6). The orientalist motifs ubiquitous in both professional performances and natural magic texts in this period were also exploited in chemical magic and were inherent in representations of 'Eastern Alchemy' in the *Chemcraft magic book* (During, 2002, p. 106; Chemcraft, 1922, p. 6). The reductive image of the East is easily criticised, not least Chemcraft's recommendation that for the occasion of the performance an assistant should be "made up" as an Ethiopian slave ... His face and arms should be blackened with burned cork ... and by all means assign him a fantastic name such as Allah, Kola, Rota or any foreign sounding word' (Chemcraft, 1922, pp. 20–21). The evocative and highly symbolic language and iconography of alchemy was nonetheless pervasive in chemical magic literature in Britain and the United States from the second half of the nineteenth century.<sup>23</sup>

'Chemical magic' manuals presented the conjuring performance as the culmination of a child's use of the toy. Like other companies advertising correspondence courses in magic for adults, both Gilbert and Chemcraft stressed that staging a magic show was a good way to 'earn a lot of extra spending money' (Gilbert, 1920, p. 7; Chemcraft, 1922, p. 3). Children were provided with a structured programme for their performance, complete with sound effects and costumes designed to a 'mystical formula'. In common with handbooks for amateur conjurers, 'chemical magic' sets offered directions on how to arrange and light a stage (Chemcraft, 1922, p. 22; Hopkins, 1904, pp. 4–5). Carefully managing how the audience perceived the experiments was prioritised; chemical substances were to be concealed, while sensorially exciting effects were to be enhanced. For instance, a white table cover was recommended to '[make] it easy for your audience to distinguish mysterious color changes [sic]' (Chemcraft, 1922, p. 22). Rather than progressing through suggested experiments systematically, children were encouraged to pick one or two, and perfect them through regular practice and repetition (Gilbert, 1920, p. 6). In 'chemical magic', the seamless incorporation of a chemistry experiment, framed as a magic trick, into the conjuring performance, was at least as important as progressively understanding the reasons for chemical reactions taking place.

In order to legitimate their products as edifying and enlightening, Gilbert and Chemcraft borrowed anti-spiritualist discourses from contemporary conjurers. The presentation of chemical tricks during carefully stage-managed performances was to be accompanied by suggestive references to 'spirits' to give the impression that the effects were produced by supernatural or occult agency (Chemcraft, 1922, pp. 2–19). According to the 'Gilbert chemical magic' manual:

There is really double fun in Chemical Magic because, besides being very mystifying to those who are initiated, you are given the chemical explanation of what takes place, so that you will actually learn quite a little about chemistry. Many of the tricks we describe here have been performed by some of the best spirit mediums, who have not only mystified, but convinced

<sup>21</sup> On science in children's periodicals, see Dixon (2001).

<sup>22</sup> Chemcraft's founder, Harold Porter, marketed his prototype toys to the purchasing agents of urban retailers as 'chemical magic kits' (see Tyler, 2003, p. 2).

<sup>23</sup> This was also true of treatises on photography and popular histories of chemistry in this period (see Dahlberg, 2006, pp. 83–110).



people that the tricks have been accomplished with the aid of the spirits or by means of some superhuman power. We explain how they are performed by purely natural means. The real fun lies in knowing how to do them and mystifying your friends. (Gilbert, 1920, p. 3)

'Chemical magic' thus signified manufacturers' commitment to a pedagogical strategy of demystification by performance. Chemistry sets marketed by Gilbert and Chemcraft in this way instructed children how to 'mystify and fascinate' an uninitiated audience, emphasising the seeming power that chemical knowledge bestowed upon the conjuror. The presence of an audience, real or imagined, was thus imperative for clarifying the pedagogical motive of 'chemical magic'. Facilitating the performance of a medley of visually, aurally and olfactorily stimulating experiments that involved colour changing liquids, disappearing inks, pungent odours and loud explosions, 'chemical magic' sets were designed to instil suspicion of evidence of the senses through familiarity with such illusions.<sup>24</sup>

Likening chemistry to 'magic' made science exciting for young consumers and the chemistry set a desirable toy. As late as 1969, a *Skil-Craft* chemistry outfit manual provided a list of 81 magic tricks using 'Hokus Pokus Chemistry ... To Amuse and Amaze Your Friends' (Koppelman, 1969, p. 3). Some models of Chemcraft's elaborate post-war chemical laboratories included a separate 'chemical magic' instruction manual, its suggestive cover featuring a turbaned magician looking into a crystal ball. The use of the magician or wizard as a metaphor for the scientist was, and still is, a popular literary device in Anglo-American culture (LaFollette, 1990, pp. 98–100). In chemistry sets, a language of magic was retained, in part, in order to perpetuate the idea that that science could provide simple, reasonable explanations for apparently magical or miraculous effects. Thus, post-war Gilbert sets also came with the message that a knowledge of chemistry 'will enable us to understand and indirectly interpret those hidden things of nature that most of us think are magical and mysterious' (Gilbert, 1952, p. 7). According to these claims, chemistry sets introduced children to the demystifying language and techniques of science, giving them not just 'hours of enjoyment', but also 'enlightenment' (Chemcraft, n.d., p. 14).

Magic represents a continuous cultural thread running through chemistry sets manufactured in the United States at least until the late 1960s. The alchemical and oriental motifs of the 'chemical magic' performance nonetheless contrasted sharply with marketing copy that came to package these toys as modern and scientific, which manufacturers increasingly adopted from the 1920s. Chemcraft and Gilbert both made the distinction between magical and scientific approaches to chemistry explicit by structuring their manuals around chapters on 'chemistry and its applications to the industries' (Chemcraft, 1933, pp. 7–28). 'Chemical magic' was framed in advertisements at least by the 1950s as appealing to the 'junior' consumer, while more advanced chemistry sets excluded 'chemical magic' manuals altogether; a marked shift from the toys produced before the 1920s (see Chemcraft, n.d., pp. 7–9). Moreover, though 'Hokus Pokus Chemistry' was incorporated within *Skil-Craft*'s manual-proper, the intention was to offer an introduction to young children working with chemicals for the first time; the bulk of the manual is devoted to more serious experiments, described in progressively more detailed and technical language. Gilbert later reflected that a broader commercial reorientation from magic to scientific toys was necessary to elevate his business in an overcrowded market (Gilbert & McClintock, 1954, p. 120). If early twentieth-century chemistry sets were designed to exploit the immense appeal of conjuring as a domestic hobby, the marginalizing of 'chemical magic' in these toys indicates

manufacturers' recognition that popular interest in magic was in decline (During, 2002, pp. 107–177).

Examples of image-laden chemistry set ephemera from the 1930s, 1940s and 1950s indicate that Chemcraft and Gilbert increasingly illustrated their toys with futuristic visual representations highlighting the role of the chemical industry in driving scientific and technological progress. Here, the reorientation from magical to scientific tropes is especially stark. Where 'chemical magic' portrayed orientalized early magicians and alchemists as men to be 'envied' because of their ability to mystify an audience with 'astounding' tricks, they were being cast elsewhere in chemistry set manuals as 'superstitious and very often dishonest men ... [who] blindly groped for mysteries' (Gilbert, 1952, p. 7). From the 1930s, Gilbert and Chemcraft exploited idealisations of boyhood common in representations of American inventiveness and technological modernity in this period (Lienhard, 2003). The inside cover of one Gilbert manual published in 1952 carried a short biography of Thomas Edison, highlighting his boyhood success in chemistry experimentation. Linking chemistry sets with industry, and with scientific icons such as Edison, manuals were intended, according to the manufacturers, to 'develop the power of scientific reasoning' (Gilbert, 1952, pp. i, 7).

For Marcel LaFollette, the scientist-hero has in the last century typically been presented as an outdoors type, self-reliant and strong, competitive, a self-made man, a "Lucky Lindy" or "Boy Scout hero" (LaFollette, 1990, pp. 106–107). Chemistry set advertisements appeared in comic books and youth magazines such as *Boy's Life*, *Open Road For Boys* or *American Boy*, primarily male-orientated publications that stressed the sort of character-building endorsed by the Boy Scouts of America (Chemcraft, n.d., p. 7). Users were, in fact, often depicted in chemistry set manuals wearing Boy Scout uniforms, while 'Boy Scout hobby instructors' were often quoted on advertisements endorsing Chemcraft products (Gilbert, 1936, p. 47; Chemcraft, n.d., p. 2). Alternatively, post-war chemistry set experiments involving disappearing or colour changing inks, previously framed as conjuring tricks to be performed at a magic show, were likened to criminological work, particularly by the FBI, an institution that was immensely influential in defining and popularising the predominant 'all-American, square-jawed' masculinity of the post-war era (Whitfield, 1996, p. 68). The presentation of these experiments as comparable to criminal investigations or espionage integrated chemistry sets into what toy manufacturers imagined as popular youth culture and familiar forms of play.

Manuals and advertisements characterised boys who played with chemistry sets as 'truth-seeking'; 'inquisitive'; 'curious, 'adventurous'; and therefore of 'of scientific mind' (for instance, Gilbert, 1937, p. 5; Chemcraft, n.d., p. 12). From the 1930s, Gilbert sets were sold under the slogan 'adventures in chemical research'; one manual from 1937 went as far to urge children to embrace the 'spirit of discovery' by undertaking their 'own original chemical experiments'. Gilbert launched a \$100 prize for the 'boy chemist of the year', who, in the company's opinion, was conducting 'the most important research in Chemistry' (Gilbert, 1937, p. 5). This does appear to represent something of an exception, however; other mid twentieth-century Gilbert manuals more conventionally insisted upon the strict following of instructions. Instructions manuals were typically present in the logos and imagery used to market chemistry sets. Experimentation thus discouraged 'carelessness' and promoted the importance of 'operat[ing] according to the "rules of the game"', while chemistry sets were advertised using images of smartly dressed, well disciplined boys (Gilbert, 1952). The emblem of a boy manipulating two test-tubes at eye-level, in the image of the laboratory chemist, crystallised as the

<sup>24</sup> On the heritage of this idea in the rational recreations genre, see Stafford (1994).

prevailing chemistry set iconography in this period.<sup>25</sup> Trained in the techniques and gestures of the laboratory, chemistry set users were to imagine themselves as scientists rather than magicians.

Enthusiasm for the research laboratory also brought about fundamental shifts in chemistry set designs. By the early 1930s, both manufacturers sold extensive ranges of chemistry sets, costing between \$1 for the most basic, and \$25 for a 'complete home laboratory' (Chemcraft, 1933, pp. 34–35).<sup>26</sup> The more expensive the set, the greater diversity of chemicals and possible experiments; price also signified differences in the age-group for which they were marketed, and also their physical appearance. Manufacturers increasingly produced models that allowed between two and four wood or metal panels to stand vertically. This design was characterised in advertising as 'laboratory-style' or 'laboratory-type' as opposed to the basic cardboard models. Thus, Chemcraft's No.6 set of 1929 included an extra wooden tray 'designed so it stands upright to form an enclosed laboratory' (Chemcraft, 1929, p. 141). The metal 'laboratory-style' model became increasingly standardized from the late 1940s, designed not only to give the chemistry set 'a modern look', but also to cultivate an association between perceived enclosed space and scientific authenticity and expertise (Tyler, 2003, p. 30).

Manufacturers reinforced this association in advertisements by suggesting that their laboratory sets were designed in consultation with university scientists and the chemical industry (Chemcraft, n.d., p. 10). Gilbert made particular claims to scientific credibility by commissioning a Professor of organic chemistry at Yale, Robert Treat Johnson to edit the instruction manuals that accompanied all Gilbert chemistry sets in this period (Gilbert, 1937, p. 2). Chemcraft underscored the superior status of the upright kits from the 1950s by classifying the less expensive cardboard box sets that lay horizontally as 'junior' or 'beginner's' models, featuring images of considerably younger boys (Chemcraft, n.d., pp. 7–8). Advertisements incorporated images of the laboratory-style set, stressing its efficacy in facilitating organised experimentation. The upright design made the chemistry set itself the theatre of play.

Chemcraft and Gilbert were thus acutely aware of the need to portray the chemistry set itself as a necessary piece of apparatus during experimentation. These manufacturers were equally astute in connecting chemistry sets, laboratories and scientific careers. Underlying claims to scientific authenticity was the strategy that dominated Gilbert and Chemcraft marketing copy in the mid twentieth century: chemistry sets were 'career toys—the playthings that lead a boy to his eventual career' (Gilbert and McClintock, 1954, p. 271). These claims emerged at a time when professional scientists were increasingly voicing their concerns about the state of science education in American schools, and taking an active role in shaping school curricula (Rudolph, 2002). The sizeable product range—from 'Beginner's Outfit' to 'Master Deluxe Laboratory'—projected the message that chemistry sets progressively resembled what a professional laboratory really looked like, guiding the 'boy chemist' towards a career in science.

#### 4. 'Ask dad for a chemistry set': advertising career toys

According to one Gilbert manual published in 1952: 'most boys are interested in science because they just naturally think they will like science' (Gilbert, 1952, p. 8). For Gilbert, an interest in science

was an inherently masculine trait; 'nature' made the research laboratory a necessarily male-dominated world. Paradoxically, manufacturers also stressed the universal pedagogical value of their toys, which meant that parents were encouraged in advertisements to buy chemistry sets for both boys and girls: half of their potential market. There was also an implicit acceptance in the slogan 'Gilbert chemistry sets bring boys and girls fame and big rewards' that girls, as well as boys, could achieve a career in science (Gilbert, 1948). In spite of this, historically contingent notions of masculinity and contemporary conventions in advertising were crucial not only to the portrayal of science in chemistry sets, but also determined how, and to whom, these toys were marketed.

It has been argued that in the post-war period, and particularly after the Sputnik launch, the American Government and professional bodies of scientists became increasingly concerned with constructing science education around military technologies as an ideological response to the politics of the cold war (Nye, 1996, pp. 225–227; Rudolph, 2002). Gilbert's and Chemcraft's preoccupation with atomic energy and 'the chemistry of outer space' in the 1950s suggests that chemistry set manufacturers were participants in this educational restructuring.<sup>27</sup> The sustained efforts of manufacturers such as Gilbert and Chemcraft to inculcate consumers with a belief in the instructional value of the chemistry set should, moreover, be seen in the context of wider public debates about the perceived inadequacy of education in American schools, especially in science, from the early twentieth century.<sup>28</sup> Chemistry set marketing tapped into widespread disaffection with the publicly funded school science curriculum, as well as concern about teacher and school facility shortages by stressing that these toys offered 'the experimenter a more extensive course in chemistry than is obtained in many schools' (Chemcraft, 1933, p. 35). Chemistry sets, according to manufacturers, empowered parents by shifting their child's science education from the school to the home.

It was thus argued that chemistry sets could facilitate intergenerational play and interaction within the family, especially between father and son.<sup>29</sup> Chemcraft included a page of 'quotes' from 'boys and their parents' in their promotional pamphlets, extolling the quality their chemistry sets, in order to emphasise the shared parent-child enjoyment that could be derived from their toys. This was particularly the case in the immediate post-war period, when the idealisations of the family acquired a pivotal importance in American culture (May, 1999). As part of the wholesale reappraisal of the family during 1940s and 50s, the meaning and importance of fatherhood came into sharp focus, prompted in part by worries that children, and especially boys, could be corrupted by excessive mothering. It was the role of the father to shape his son's masculinity, and this meant taking an active interest in his hobbies and engaging in his play (ibid., pp. 129–131).<sup>30</sup> Gilbert and Chemcraft advertisements from this period typically featured young boys using their chemistry sets under the supervision of their fathers or older brothers.

One should not, however, overstate the influence of the political and cultural climate of the cold war on chemistry set marketing copy. Though military technologies were highlighted in post-war advertising and ephemera, manufacturers also preserved the longer standing tradition of encouraging children to think of the practically oriented chemistry of everyday life when using their toys.

<sup>25</sup> This is undoubtedly the predominating image used by chemistry sets, manufactured in both the United States and Britain ca. 1930 to 1970, in the Whipple collection.

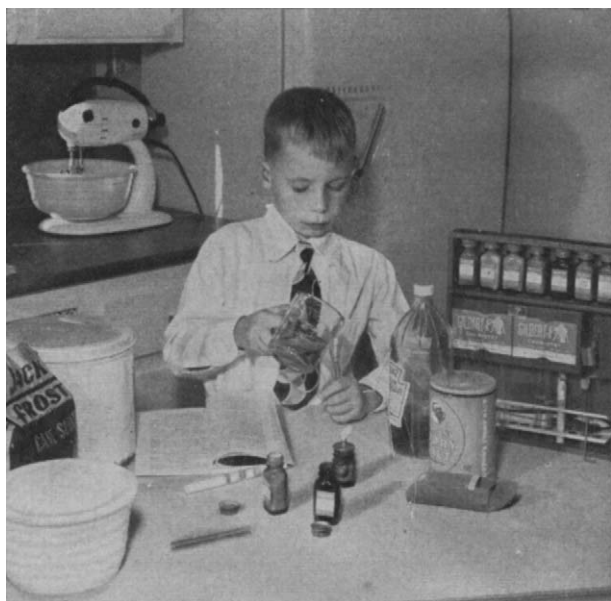
<sup>26</sup> The price of lower range chemistry sets sold by Gilbert and Chemcraft ca. 1930 is comparable to that of, for instance, a baseball mitt and bat (\$1.25) or a hardcover best-selling novel (\$2.00) (see Young & Young, 2002, pp. 280–282).

<sup>27</sup> See Chemcraft catalogue printed in Tyler (2003), pp. 41–46. On atomic energy kits, see Watson (2002), pp. 179–182.

<sup>28</sup> On disaffection with science education, see Rudolph (2002, pp. 33–55; 2005, pp. 353–389); Young & Young (2002), p. 18.

<sup>29</sup> This was a common feature of much toy advertising in twentieth century America (see Cross, 1997, pp. 53–54). Gilbert chemistry sets from the 1950s depicted a teenage boy playing with his younger brother.

<sup>30</sup> There is a large, interdisciplinary scholarship on American fatherhood in this period. For a recent interpretation, see LaRossa (1997), esp. pp. 1–20.



**Fig. 2.** 'Household chemistry', from *Gilbert home chemistry* (Gilbert, 1954; E.281, used with the permission of the Whipple Museum of the History of Science, University of Cambridge). Caption in original reads: 'Kitchen Chemistry includes a formula, ingredients, measures, mixing bowls, thermometer, heat and refrigeration'.

Household kitchens, 'filled with chemical materials and "laboratory equipment"' were identified as ideal spaces for chemistry set play (Gilbert, 1952, p. 2). Experiments using 'everyday household products' such as food and soap were as prevalent in chemistry sets sold in the 1930s as they were after World War Two (Gilbert, 1954, p. 4; see Fig. 2). Post-war marketing copy represented chemistry as a science of civilisation with palpable domestic benefits (Gilbert, 1952, p. 8). Yet the marketing of chemical recreations as family amusements that helped spread civilisation and cement domesticity did not begin in the twentieth century. Such rhetoric was equally apparent in manuals sold by Griffin in Britain almost a century earlier, while 'chemical magic' was advertised to Victorian families as 'a social amusement for the home circle'; 'an ever-changing always tempting, stay-at-home inducement'; and this regard was an 'important moral assistant of no unimportant description' (Aldine Publishing Company, [1894?], p. i).

With such value given to the family and the domestic, reciprocal attitudes to femininity are inevitably woven through all aspects chemistry set designs and advertising, and instruction manuals. There is a vast literature on the ideology of 'separate spheres' in post-war America—a terminology that is now unfashionable and undoubtedly problematic (for instance, see Meyerowitz, 1993, pp. 1455–1482). However, that chemistry set users were repeatedly instructed to acquaint themselves with the 'chemistry' that took place in 'mother's kitchen' exemplified contemporary tropes regarding the gendered division of domestic space (Gilbert, 1954, p. 11). Instructions manuals from the 1930s show us that chemistry sets were advertised as useful to girls in preparation for a domestic life rather than a career in science. As one manual put it in 1933 'in the home, the housewife who knows nothing of the chemistry of the foods she prepares or the materials which she uses daily is handicapped' (Chemcraft, 1933, p. 4). In precisely the same period that consumption was increasingly identified as female, chemistry set advertising advanced the view that chemistry was produced by men and consumed in the form of food and household products by women.<sup>31</sup>

The visual and literary rhetoric that predominated in chemistry set ephemera is best understood in the context of contemporary advertising conventions. In associating their products with national progress, these manufacturers drew on the most recognisable and enduring advertising techniques (Laird, 1998). The earliest Gilbert and Chemcraft chemistry set manuals cultivated the idea that America was on the threshold of a 'New Age of Chemistry', driven by 'spectacular, exciting new chemical discoveries' (Chemcraft, n.d., p. 10). According to one Chemcraft manual in 1933: 'the country which leads in chemical industries will ultimately be the richest and most powerful' (Chemcraft, 1933, p. 4). Political rhetoric of this sort dominated advertising and instruction manuals after World War Two, particularly through references to the benefits of atomic energy. Chemistry sets increasingly emphasised the political utility of science, and the inevitability of progress in research. Scientists were identified as national heroes, 'our most priceless possessions', and laboratories as the spaces in which 'the great industrial problems of the day' were solved (Gilbert, 1952, p. 8).

With the rise of a class of advertising professionals in the United States who, from the turn of the twentieth century, increasingly represented themselves as arbiters of modernity, advertisements began to portray individual, cultural and national progress as the end results of consumers' decisions (see Laird, 1998, p. 7). Gilbert and Chemcraft followed this trend by conflating issues of paternal responsibility with scientific progress and national prestige, placing the chemistry set at the forefront of America's drive towards scientific modernity. Manuals and packaging portraying children using their chemistry sets regularly featured background images of scientists in lab-coats: visualisations of the child-chemist's promising future. Marketing stressed that the 'boy experimenter' and his future incarnation as a scientist used identical apparatus: chemistry sets taught children how to become scientists, but also, it was implied, good citizens: 'a population educated in the science of chemistry is the greatest asset your country can have' (Chemcraft, 1933, p. i). The message that 'today's adventures in science will create tomorrow's America', emblazoned on the packaging of post-war Gilbert chemistry sets alongside futuristic images of chemical industries reminded parents that it was their responsibility as citizens to provide their children with a complete education in science.

Post-war chemistry set marketing also continued a more important tradition, discernable from the 1930s, that emphasised the father's responsibility for guiding boys towards a successful career. We see advertisements making claims of the type: 'when your son asks for Chemcraft, he is asking you to make an important, worthwhile investment in his future' (Chemcraft, n.d., pp. 13–14). It was a common feature of Depression era advertising to suggest that fathers had to give their sons a 'running start in life' (Marchand, 1985, pp. 330–332). Thus, according to the 1933 *Chemcraft* experiment book: 'Today no matter what profession a man follows, he is greatly handicapped without a knowledge of chemistry. The manufacturer, the farmer, the tradesman, the professional man, the scientist, all have constant need of chemical knowledge' (Chemcraft, 1933, p. 4). Over the next two decades, Chemcraft advertisements continued to promise that 'fun, thrills, adventure await boys who ask dad for Chemcraft' and remind consumers that 'a wise father thinks' to buy his son a chemistry set (printed in Tyler, 2003, p. 100). With contemporary notions of masculinity so tightly connected to career success, rhetoric such as this presented the chemistry set as a crucial part of a boy's education. Chemistry set advertising appeared in popular science journals for adults, *Popular Mechanics*, for instance, emphasising the importance of confidence and character-building, and the need to develop skills to secure a

<sup>31</sup> On the creation of the consumer as female, see Marchand (1985).



well-paying career. Chemistry set marketing was thus largely addressed to parents, particularly fathers, stressing that they were responsible for guiding their sons towards 'a position of importance and responsibility when [he reaches] manhood' (Chemcraft, n.d., p. 1). In emphasising fatherhood so strongly in chemistry set advertisements, such messages implied that 'boy-chemists' were, like their fathers, future breadwinners, builders of families and domestic security.

Though both Gilbert and Chemcraft did increasingly commission advertising professionals and specialist packaging designers, much of the responsibility for marketing nonetheless remained within the boardrooms of these companies (Tyler, 2003, pp. 2, 39; Gilbert & McClintock, 1954, p. 130). Manufacturers thus retained a prominent place in chemistry set advertising, highlighting their personal contributions to individual and national progress. According to one marketing slogan, 'more boys have won fame and big awards with Gilbert Chemistry Sets than any other kind made' (Gilbert, 1937, p. 1). The founders of these companies, A. C. Gilbert and Harold Porter wrote 'personal' letters in chemistry set manuals to 'boy-chemists', encouraging them in their scientific pursuits, and stressing that 'the need for chemists is greater now than ever before in our country's history' (Gilbert, 1952, p. 2). In his autobiography Gilbert recalled the success of this marketing strategy: 'I wanted the ads to read like they were personal messages from me to the boys ... I was convinced that boys became interested and excited when a *person*, not a corporation spoke to them. And I must have been right, for the letters began to flood us' (Gilbert & McClintock, 1954, p. 130). The notion of 'paternal' nurturing therefore had immense symbolic importance to the marketing of chemistry sets, for instilling the intertwined qualities of scientific interest, career determination, and good citizenship.

## 5. Conclusions

This article has traced changes and continuities in the marketing copy of the chemical recreations genre from end of the nineteenth to the mid twentieth centuries. I have argued that the chemistry sets produced by Gilbert and Chemcraft in the United States from the second decade of the twentieth century were an amalgam of the objects and texts of Anglo-American chemical recreations that proliferated in the preceding decades. Chemistry set marketing, whether published in the form of a magazine advertisement or within an instruction manual, is an important part of the material culture of these toys. Skil-Craft, who entered the market some decades after Gilbert and Chemcraft reminded parents in 1969: 'children who cannot read or who cannot or will not follow the instructions in the manual should not be allowed to use this set' (Koppelman, 1969, p. i). Ultimately, textual instruction was as necessary for a home chemistry education as experimentation, to the extent that manuals often substituted the chemistry sets themselves: in the library of conjuring ephemera collected by Harry Price, and in company advertising imagery. These literary and visual guides claimed to provide discipline and safety. Whether constructing their users as 'young alchemists' or 'boy chemists', they also gave figurative meaning to chemicals, apparatus, experiments and to the sets themselves.

A manufacturer-centred account of marketing inevitably risks projecting our reading of abstract cultural messages onto an invisible audience. That one visitor to a late twentieth-century museum exhibition recollected that 'I had a chemistry set like this as a kid, couldn't figure out much, just never had the patience' indicates that users' experiences did not necessarily correspond with the

widely advertised contention by both British and American manufacturers that these toys were fun, safe and simple to use. Other visitors' recollections suggest that instructions manuals were not always followed.<sup>32</sup> On the whole, manufacturers insisted that only experiments listed in manuals should be performed, and guidelines regarding apparatus and quantities of chemical should be strictly followed. In his 1903 manual, *Second steps in chemistry*, the British manufacturer W. E. Statham instructed users that 'the indiscriminate mixing of otherwise harmless chemicals may also easily give rise to consequences of a most serious nature, so the young chemist should never experiment on his own account *just to see what would happen by mixing this and that*' (W. E. Statham & Sons, 1903, p. i). This warning was equally prominent in American sets sold in subsequent decades: 'hazard can be avoided by careful adherence to all instructions' (Koppelman, 1969, p. i).

The Gilbert manual published in 1937 that did promote 'original research in chemistry', and by implication a heuristic pedagogy, is an exception that must be explained. Manufacturers' efforts to portray chemistry sets as small-scale replications of scientific laboratories were incorporated into a wider polemic extolling the importance of an adventurous scientific profession in ensuring a prosperous future for the United States. In common with broader advertising strategies in the United States in this period, toy manufacturers linked scientific progress with discourses of masculinity and domesticity to market their toys, which increasingly came to be presented as replications of a real laboratory environment. Manufacturers of chemistry sets relied upon diverse, intersecting popular cultures to market their products. With origins in the nineteenth-century tradition of parlour magic, early twentieth-century American chemistry sets were intended to facilitate the performance of so-called 'chemical magic' demonstrations. Though preserved in mid-twentieth-century toys, manufacturers increasingly exploited this heritage as a counterpoint to the predominant chemistry set iconography: the future scientist.

## Acknowledgements

I am very grateful for comments on earlier versions of this paper, to Nick Hopwood, Liba Taub, and two anonymous M.Phil. examiners; to Steve Kruse for help with images; and to Rosie DiVernieri of the Chemical Heritage Foundation, Philadelphia, for supplying me with useful references and materials from their collection. This paper benefited enormously from discussions at the Max Planck Society's International Research Network's Wandering Seminar on the 'History of Scientific Objects' and an MPhil seminar, both held in this Department; and at the International Conference '19th Century Chemistry: Spaces and Collections' held at the Museum of Science of the University of Lisbon.

## References

*Items from the collections of the Harry Price Library, University of London Library and the Whipple Museum of the History of Science are identified by [HPL] and [Wh] respectively.*

- Aldine Publishing Company. [1894?]. *Chemical tricks, for home amusement and instruction*. The Aldine Boy's Own Magic & Trick Books, 6. London: Aldine. [HPL]
- Anderson, A. (1894). *How to do chemical tricks: Containing over one hundred highly amusing and instructive tricks with chemicals*. New York: F. Tousey.
- Anderson, P. (1994). *The printed image and the transformation of popular culture, 1790–1860*. Oxford: Clarendon.
- Bailey, P. (1978). *Leisure and class in Victorian England: Rational recreation and the contest for control 1830–1885*. London: Routledge.
- Ball, D. (1967). Toward a sociology of toys: Inanimate objects, socialization, and the demography of the doll world. *Sociological Quarterly*, 8, 447–458.

<sup>32</sup> See quotations from 'Chuck' and 'Deborah' ('Can you believe all the things we subjected ourselves to as kids in those days (and subjected our siblings to)') (National Museum of American History, n.d.).

- Barthes, R. (2000). *Mythologies* (A. Lavers Trans.). London: Random House. (First published 1957)
- Brehm, D. (1999). Best-selling authors talk about writing on science for a lay audience. *Massachusetts Institute of Technology News Office*, 24 February. <http://web.mit.edu/newsoffice/1999/forum-0224.html>. (Accessed 14 January 2006)
- British standard handbook of chemical wonders for home exhibition. (n.d.) London: J. & R. Maxwell. [HPL]
- Brockman, J. (Ed.). (2005). *Curious minds: How a child becomes a scientist*. London: Random House. (First published 2004)
- Brunel, G. (1901). *Fun with magic: Amusing experiments in physics, chemistry and geometry*. Chicago: Jamieson Higgins Co. [HPL]
- Butler, J. (1990). *Awash in a sea of faith: Christianizing the American people*. Cambridge, MA: Harvard University Press.
- Chemcraft. (n.d.). *Chemcraft wonders of chemistry*. Hagerstown: Chemcraft. [Wh]
- Chemcraft. (1922). *The Chemcraft magic book*. Hagerstown: Chemcraft. [HPL]
- Chemcraft. (1929). Entirely new Chemcraft ... Real fun with chemistry! *Popular Mechanics Magazine*, 52(6), 141. [Wh]
- Chemcraft. (1933). *The Chemcraft book*. Hagerstown: Chemcraft. [Wh]
- Connor, S. (2002). *Sleights of voice: Ventriloquism, magic and the Harry Price Collection*. <http://www.bbk.ac.uk/english/skc/hpc/>. (A talk given to the Friends of the University of London Library, 28 November)
- Cooter, R., & Pumfrey, S. (1994). Separate spheres and public places: Reflections on the history of science popularization and science in popular culture. *History of science*, 32, 237–267.
- Cross, G. (1997). *Kid's stuff: Toys and the changing world of American childhood*. Cambridge, MA: Harvard University Press.
- Cross, G. (2000). *An all-consuming century: Why commercialism won in modern America*. New York: Columbia University Press.
- Dahlberg, L. (2006). The material ethereal, photography and the alchemist ancestor. In J. Wamberg (Ed.), *Art and alchemy* (pp. 83–110). Oxford: Oxbow Press.
- De Grazia, V., & Furlough, E. (Eds.). (1996). *The sex of things: Gender and consumption in historical perspective*. Berkeley & Los Angeles: University of California Press.
- Dixon, D. (2001). Children's magazines and science in the nineteenth century. *Victorian Periodicals Review*, 34, 228–238.
- During, S. (2002). *Modern enchantments: The cultural power of secular magic*. Cambridge, MA: Harvard.
- Fox, S. (1997). *The mirror makers: A history of American advertising and its creators*. Illinois: University of Illinois Press.
- Gee, B. (1989). Amusement chests and portable laboratories: Practical alternatives to the regular laboratory. In F. James (Ed.), *The development of the laboratory* (pp. 37–59). London: Macmillan.
- Gilbert. (1936). *Gilbert experimental glass blowing for boys*. New Haven: Gilbert. [Wh]
- Gilbert. (1937). *Gilbert chemistry for boys*. New Haven: Gilbert. [Wh]
- Gilbert. (1948). *Scientific wonders for boys and girls*. New Haven: Gilbert. [Wh]
- Gilbert. (1952). *Fun with Gilbert chemistry*. New Haven: Gilbert. [Wh]
- Gilbert. (1954). *Gilbert home chemistry*. New Haven: Gilbert. [Wh]
- Gilbert, A. C. (1920). *Gilbert chemical magic*. New Haven: Gilbert. [HPL]
- Gilbert, A. C., & McClintock, M. (1954). *The man who lives in Paradise*. New York: Rinehart & Company.
- Good, A. (1894). *Magical experiments, or science in play* (C. Curwen, & R. Waters, Trans.). Philadelphia: David McKay. [HPL]
- Griffin, J. J. (1860). *Chemical recreations: A popular manual of experimental chemistry* (10th ed.). London: J. J. Griffin & Sons. [HPL]
- Griffin, J. J. (1879). *Chemical handicraft: An illustrated and descriptive catalogue of chemical apparatus and reagents manufactured and sold by John J. Griffin and Sons Ltd. Makers of scientific instruments to the Admiralty, War Office, the India and Colonial Governments of Kingsway, London* (8th ed.). London: J. J. Griffin & Sons. [HPL]
- Hall, T. (1978). *Search for Harry Price*. London: Duckworth.
- Hargittai, I. (2002). *The road to Stockholm: Nobel Prizes, science and scientists*. Oxford: Oxford University Press.
- Hopkins, N. M. (1904). *Twentieth-century magic and the construction of modern magical apparatus; with the introduction of new experiments mechanical, chemical, electrical: A treatise on the construction and introduction of scientific magical apparatus*. London: Routledge. [HPL]
- Houdini, H. (1924). *A magician among the spirits*. New York: Harper and Brothers.
- Hughes, T. (1990). *American Genesis: A century of invention and technological enthusiasm, 1870–1970*. London: Penguin.
- Huizinga, J. (1970). *Homo ludens: A study of the play element in culture*. London: Routledge & Kegan.
- Johnson, V. (1912). *Chemistry and chemical magic*. New York: Hodder & Stoughton.
- Johnson, V. (1920). *Chemical magic: Entertaining tricks and experiments with simple apparatus*. London: Humphrey Milford.
- Knight, D. (2004). The 2003 Edelstein Award address: Making chemistry popular. *Bulletin for the History of Chemistry*, 29(1), 1–8.
- Knight, D. (2006). Popularizing chemistry: Hands-on and hands-off. *HYLE International Journal for the Philosophy of Chemistry*, 12(1), 131–140.
- Koppelman, R. (1969). *Skil-Craft exploring chemistry experiment manual*. Chicago: Skilcraft. [Wh]
- LaFollette, M. (1990). *Making science our own: Public images of science 1910–1955*. Chicago: Chicago University Press.
- Laird, P. W. (1998). *Advertising progress: American business and the rise of consumer marketing*. Baltimore: Johns Hopkins University Press.
- LaRossa, R. (1997). *The modernization of fatherhood: A social and political history*. Chicago: Chicago University Press.
- Leigh, J.W. (1903). To the editor of *The Times*. *The Times*, 3 January, 8.
- Lerman, N., Oldenziel, R., Mohun, A. (Eds.). (2003). *Gender & technology: A reader*. Baltimore: Johns Hopkins University Press.
- Lienhard, J. (2003). *Inventing modern: Growing up with X-rays, skyscrapers, and tailfins*. Oxford: Oxford University Press.
- Linnett, W. (1909). *Chemistry in magic*. New York: Society of American Magicians. (Paper read before the Society of American Magicians, 6 February) [HPL]
- Lippy, J., & Thurston, H. (1930). *Chemical magic*. New York: G. Sully & Co. [HPL]
- Marchand, R. (1985). *Advertising the American dream: Making way for modernity, 1920–1940*. Berkeley: University of California Press.
- May, E. (1999). *Homeward bound: American families in the cold war era* (2nd ed.). New York: Basic Books.
- Meyerowitz, J. (1993). Beyond the feminine mystique: A reassessment of post-war mass culture 1946–1958. *Journal of American History*, 79(44), 1455–1482.
- National Museum of American History. (n.d.). *History in your home responses*. <http://americanhistory.si.edu/collections/homehistoryres.cfm>. (Accessed 24 January 2007)
- Noakes, R. (2004). The Boy's Own paper and late-Victorian juvenile magazines. In G. Cantor, G. Dawson, G. Gooday, R. Noakes, S. Shuttleworth, & J. Topham, *Science in the nineteenth-century periodical: Reading the magazine of nature* (pp. 91–122). Cambridge: Cambridge University Press.
- Nye, M. J. (1996). *Before Big Science. The pursuit of modern chemistry and physics, 1800–1940*. Harvard: Harvard University Press.
- Price, H. (1936). *Confessions of a ghost-hunter*. London: Putnam.
- Price, H. (1942). *Search for truth: My life for psychical research*. London: Collins.
- Pursell, C. (1979). Toys, technology and sex roles in America, 1920–1940. In M. Trescott (Ed.), *Dynamos and virgins revisited: Women and technological change* (pp. 252–267). New York: Methuen.
- Rudolph, J. (2002). *Scientists in the classroom: The cold war reconstruction of American science education*. New York: Palgrave Macmillan.
- Rudolph, J. (2005). Turning science to account: Chicago and the General Science movement in secondary education, 1905–1920. *Isis*, 96, 353–389.
- Sacks, O. (1999) Hard times for curious minds. *New York Times*, 13 May.
- Schmidt, J. (2000). Yesterday's toy becomes tomorrow's trade. *Today's Chemist at Work*, 9(9), 42–48.
- Seasonable indoor amusements: Chemistry and conjuring. (1880–1881). *Boy's Own Paper*, 3, 165–166.
- Stafford, B. M. (1994). *Artful science. Enlightenment entertainment and the eclipse of visual education*. Cambridge, MA: The MIT Press.
- Stanyon, E. (1909). *Fire and chemical magic for drawing room and stage performances. Containing full explanations of all the latest and most startling chemical colour change tricks*. London: E. Stanyon & Co. [HPL]
- Sternberg, E. (1999). *The economy of icons: How business manufactures meaning*. Westport, CT: Praeger.
- Straightforward conjuring tricks, Pt. IV: Some curious cases of crystallisation. (1880–1881). *Boy's Own Paper*, 3, 421–422.
- Tabori, P. (1950). *Harry Price. The biography of a ghost-hunter*. London: Athenaeum Press.
- Taylor, F. S. (1934). *The young chemist*. London: Nelson.
- Turner, G. (1987). Presidential address: Scientific toys. *British Journal for the History of Science*, 20, 377–398.
- Tyler, J. (2003). *The Chemcraft story: The legacy of Harold Porter*. Haworth: St. Johann Press.
- Von Korff, R. W. (2006). Where have all the chemistry sets gone? *The Midland Chemist*, 43, 5.
- W. E. Statham & Sons. (n.d.). *Statham's first steps in chemistry: 140 select and amusing chemical experiments*. London: W. E. Statham & Sons. [HPL]
- W. E. Statham & Sons. (1903). *Statham's second steps in chemistry: Being a handbook intended as a companion to students' chemical and apparatus cabinets and portable laboratories etc*. London: W. E. Statham & Son. [HPL]
- Warner, D. J. (1988). Commodities for the classroom: Apparatus for science and education in antebellum America. *Annals of Science*, 45, 387–397.
- Watson, B. (2002). *The man who changed how boys and toys were made: The life and times of A. C. Gilbert, the man who saved Christmas*. New York: Penguin.
- Whitfield, S. (1996). *The culture of the cold war* (2nd ed.). Baltimore: Johns Hopkins University Press.
- Williams, H. L. (Ed.). (1857). *The magician's own book, or, The whole art of conjuring*. New York: Dirk & Fitzgerald. [HPL]
- Wright, C. A. R. (1890). *The threshold of science: A variety of simple and amusing experiments illustrating some of the chief physical and chemical properties of surrounding objects, and the effects upon them of light and heat*. London: Richard Griffin. [HPL]
- Young, W. H., & Young, N. K. (2002). *The 1930s*. Westport, CT: Greenwood Press.